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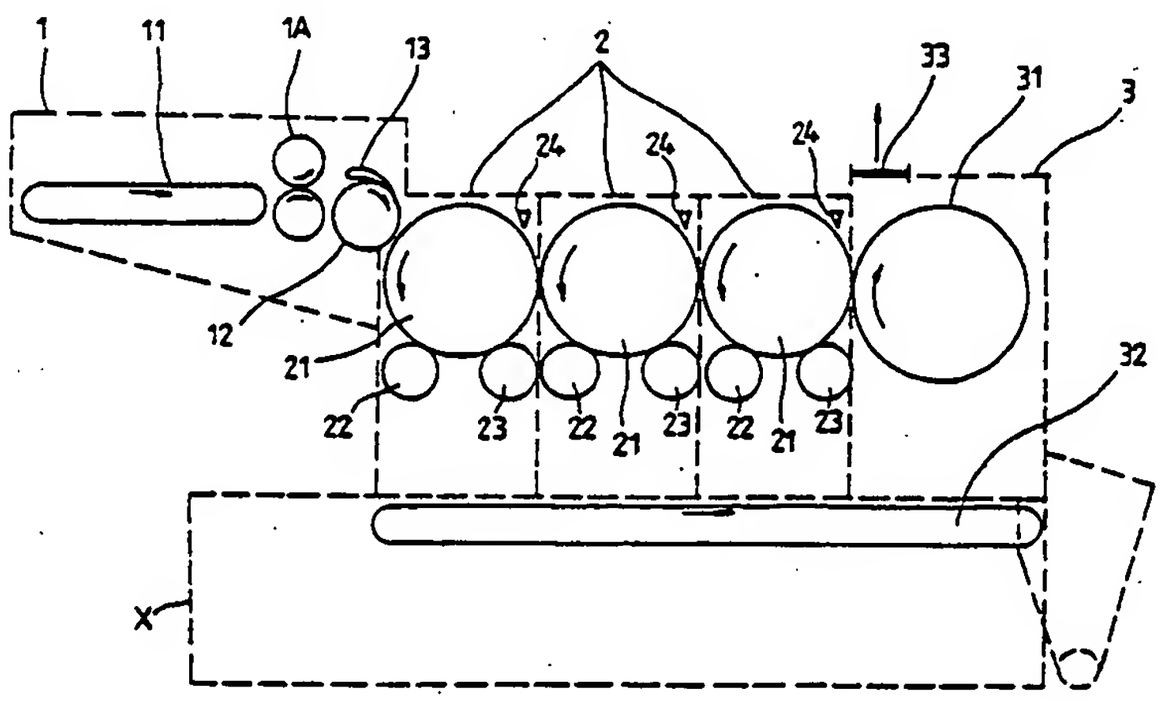

(57) Abstract

The invention relates to a method of, and a device for, fibre production, in particular by recycling otherwise waste fibre materials such as flax and cotton waste; waste of carpets and textile fabrics, other natural and synthetic fibre materials, sandwich fibre containing materials and composite materials with non–metallic fibre reinforcement such as tyres with non–metallic cord, in which the fibre material is pressed in a contact pressure line by a thrust onto a feed roller (12) fitted with articulated surface, and is taken off the contact pressure line by an opener roller (21) fitted with articulate surface. The contact pressure line is provided between the articulated surface of the feed roller (12) and a holding member (13) related to said feed roller (12), and the value of the pressure force (thrust) varies throughout the length of the contact pressure line according to the thickness of the fibre materials at the respective section of the contact pressure line.

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A Method of Fibre Production and a Device for Carrying out the Method

Technical Field

The invention relates to a method of, and device for, fibre production, in particular by recycling otherwise waste fibre materials such as flax and cotton waste, waste of carpets and textile fabrics, other natural and synthetic fibre materials, sandwich fibre containing materials and composite materials with non-metallic fibre reinforcement such as tyres with non-metallic cord, in which the fibre material is pressed in a contact pressure line by a thrust onto a feed roller fitted with articulated surface, and is taken off the contact pressure line by an opener roller.

Background Art

In the traditional method of textile fibre opening, separate fibre layers or tuffs are taken from pressed fibre bales in the opening rooms of spinning mills and continuously opened on feeders, beater openers and scutchers into fibre tuffs which are fed then in the form of a roll or directly from hopper shafts to be singled out on carding machines with carded sliver as the final product.

In technological respect, this traditional method of fibre opening unavourably affects the final product especially if the material to be opened and cleaned is considerably soiled, because the fibre tuffs, while passing in succession through a series of cleaning and opening stations, get closed, so that the impurities contained therein are very difficult to exclude while the fibres are singled out on carding machines. Fine or not strong enough fibres are more or less damaged by this operation. To do away with these drawbacks, several measures have been proposed in the form of additional devices intended still further to open and clean the fibre tuffs before the carding operation proper.

The drawback of such additional devices consists in that they only additionally solve the problem of the opening and cleaning of the fibre material and are made either as separate pre-cleaning machines intended to prepare the fibre material before the singling out process proper or as a mere modification of the feed device of the carding

machine. Besides, they require additional floor space and involve complications in the pneumatic distribution lines serving to suck off dust, impurities, and waste.

To remove this drawback there has been proposed a solution disclosed in the CS A0 242702 relating to the mechanical stripping of feathers or to the opening and cleaning of textile materials and disclosing a device in which the materials are brought in a uniform layer by a feed path suitable for the material in question into contact with a plurality of systems of opener rollers whose surfaces are fitted with opener members made as points, teeth, needles, or otherwise roughened areas. In the direction of the material feed, both the roller speed and the density of the opener members of each system increase. During the opening process, the impurities are separated either by spontaneously falling out or by hitting the stationary or rotating cleaning members appropriately arranged near the opener rollers.

The opening and separation of impurities are followed by the mixing, usual doffing, and sucking off, of the opened material.

The drawback of this solution consists in that it is only applicable to the opening and cleaning of chips of woven and knitted fabrics or yarn bundles and of chips of soft needle-processed webs or of soft felt, but not to compact and relatively strong woven fabrics or fibre waste.

Another well-known solution of a device for opening, cleaning, and singling out of the fibre material, disclosed in the CS A0 255402, is based on the use of a single continuous device in which the fibre tuffs are in succession opened, cleaned, and singled out to separate fibres, the final product being a sufficiently cleaned carded sliver suitable, among others, to be spun on open-end spinning machines. Related to each opener and singling out roller are driven underpressure perforated rollers fitted with saw-shaped cover for doffing the fibre material from these opener or singling out rollers. The reason why the arrangement of the perforated doffing rollers in functional relation to the opener and singling out rollers from whose working surface the fibre material in process of opening and singling out is doffed and cleaned, increases the effect consists among others in that these operations are carried out on a single combined device in which the efficiency of the opening, cleaning, and singling-out can be modified by the number of the opener, singling out, and perforated doffing rollers.

However, the drawback of this device consists exactly in the necessity to use perforated doffing rollers thus increasing both the amount of energy needed for the whole process of opening, singling out and cleaning of the fibre material and the complexity and investment costs of the device. Besides, the device manages to process only the fibre material presented in the form of fibre tuffs.

An improvement on the just described solution is disclosed in the patent specification CZ PS 277 232 comprising waste containers situated each under each opener or singling out roller and used to feed the primary mixed waste from the respective section of the device back to its inlet section. This, on the one hand, reduces the fibre loss but, on the other hand, increases the complexity, and consequently the investment costs, of the device which, like the preceding one, manages to process only the fibre material presented in the form of fibre tuffs.

Another solution, described in the state of art of the patent specification CZ PV 00549-92, relates to a machine for the opening and breaking of textile materials fitted with a feed device intended to feed the textile products or waste materials through a group of breaking units arranged in a line out of which each breaking unit contains a breast drum or breast roller carrying on its circumference pegs or needles and at least one rotating feed roller situated in front of the breast drum or roller and at the same time at the end of a feed belt. Behind the breast drum or roller, the material being processed is gathered on a gathering plate and is sucked into a perforated rotating drum in which an air exhauster maintains underpressure and acts as a filter. Situated on the lower side of said breaking machine is a feed belt used to feed the unbroken parts of rags or fibres back into the inlet feed system.

This type of breaking machines is made in unit construction system, in other words, the fibres pass through a plurality of construction units, each of them fitted with a breaking device comprising a breast drum and related complementary parts, and each of them acting as one breaking step or breaking station. Such well-known machines comprise two to six breaking stations, and the fibre material inevitably must pass through every and all stations of the machine in question in order to be gathered at the outlet of the last breast drum.

In practice, however, some fibre types require to be processed on a comparatively large number of breaking stations arranged in a line while other fibre

types require the use of only one or two breaking stations arranged in a line. This involves the necessity to have a number of machines different from each other only by the number of breaking stations arranged in a line and consequently correspondingly high investment costs of such a machine set.

This problem has been solved by the patent application CZ PV 00549-92 published on the 16.09.1992 and disclosing a breaking machine comprising an inlet filling station equipped with a first feed hopper for supplying waste material, and with a second feed hopper, each of the two types of fibre material being supplied separately to the inlet feed belt. The machine comprises a plurality of breaking stations with there between situated groups of ventilators equipped with lateral inlet apertures adapted to be closed by doors and feeding the material being processed from the preceding breaking station into a separation box in whose inner space the dust is separated on a sharp bow of a pipeline with perforated outer part on which the dust passes through the perforation apertures while the fibre material falls down and is either fed to the next breaking station or, if. the fibre material has been sufficiently processed, it is fed to the machine end by the outlet pipeline.

The drawback of this solution consists in the necessity to use ventilators and a pipeline for feeding and cleaning the fibre material and in the accordingly higher investment costs of such machines.

The invention intends to do away with, or at least to reduce to a minimum, the drawbacks inherent to the state of art.

Principle of the Invention

The goal of the invention has been reached by a method of fibre production whose principle consists in that the value of the pressure force varies throughout the length of the contact pressure line depending on the thickness of the fibre material in the contact pressure- line thus eliminating the inf1uence of the variations in the thickness of the fibre material on the course of its opening process.

Preferably, the position of the contact pressure line on the circumference of the opener roller is adjustable around said circumference of said feed roller, thus permitting to obtain the required staple length of the fibres in process of production.

The principle of the device for carrying out the method of production according to the invention consists in that there is provided a pressure element made as a holding member embracing an articulated surface of the feed roller on a part of its circumference and adapted to swing and to be radially adjustable with respect to the articulated surface of the feed roller, while being at the same time coupled with an adjusting and pressure device, thus achieving the opening even of very strong fibre containing materials and at the same time the possibility of readjusting the device quickly and exactly to another type of fibre material.

The holding member is preferably made as an elastic element preferably coupled with at least two independent adjusting and pressure devices so as to obtain a more perfect distribution of the thrust (pressure force) throughout the length of the contact pressure line.

The principle of another preferred embodiment of the device for carrying out the method of the fibre production according to the invention consists in that the pressure element is made as a holding member comprising at least two segments embracing the articulated surface of the feed roller on a part of its circumference, each of the two segments being adapted to swing and to be radially adjustable with respect to the articulated surface of the feed roller while being at the same time coupled with an independent adjusting and pressure device so as to obtain a more perfect distribution of the thrust (pressure force) throughout the length of the contact pressure line and to reduce to a minimum the influence of the elastic deformation of the pressure element on the fibre material opening process.

The pressure element is preferably seated adjustably around the circumference of the feed roller, thus permitting to achieve a predetermined staple length of the fibres to be produced.

According to another preferred embodiment of the device for carrying out the method of the fibre production according to the invention, the feed roller is preceded by a feed belt vertically adjustable with respect to the rotation axis of the feed roller and by means of this able to optimize the conditions under which the fibre material is fed to the feed roller.

According to still another preferred embodiment of the device for carrying out the method of the fibre production according to the invention, at least one cleaning means

is related to the upper part of the circumference of at least one opener roller so as to increase the efficiency of the cleaning component of the process of opening and cleaning the fibre material by increasing the cleanliness of the surface of the opener roller fitted with cleaning means arranged in such position.

Description of the Drawings

An example of embodiment of the device for carrying out the method of the fibre production according to the invention is shown in the accompanying drawings in which Fig. 1 shows the arrangement with the feed belt, and Fig. 2 shows the elevation view of the general arrangement of the device equipped with three opening and cleaning sections.

Examples of Embodiment of the Invention

The device for fibre production from fibre materials, in particular by recycling suitable waste fibre materials such as flax and cotton waste, waste of carpets and textile fabrics, other natural and synthetic fibre materials, composite materials with non-metallic fibre reinforcement such as tyres with non-metallic cord, etc., comprises a feed device 1, at least one opening and cleaning section 2, and an outlet section 3.

In the example of embodiment shown in Figs. 1 and 2, the feed device 1 contains a well-known feed belt 11 seated in a frame X. Behind said feed belt 11, considered in the direction of the material feed, the frame X carries a rotatably seated feed roller 12 whose articulated surface is equipped with a well-known

saw-shaped surface, and the position of the functional area of the feed belt 11 with respect to the rotation axis of the feed roller 12 is vertically adjustable as shown in Fig. 1 by the direction Y. The feed device can also contain a rotatably mounted cylinder detector 1A of metallic particles and of other hard material that may be situated either in front of, or behind, the feed belt 11, considered in the direction of the fibre feed .

In another, not illustrated example of embodiment, the device also comprises a well-known ancillary feed device containing at least one ancillary roller for stretching the fibre material entering the contact pressure line. Considered in the direction of the

fibre feed, said ancillary feed device is situated in front of the feed roller 12, and the position of the ancillary feed device with respect to the rotation axis may be vertically adjustable.

Above the feed roller 12, and parallel to it, the frame X of the device carries a holding member 13 adapted to swing and adjustable with respect to the articulated surface of the feed roller 12, embracing the articulated surface of the feed roller 12 and thus creating between the feed roller 12 and the holding member 13 a channel continuously narrowing from the inlet edge 131 of the holding member 13 to the outlet edge 132 of the holding member 13. In the not illustrated example of embodiment, the holding member 13 is coupled with a set screw and a spring forming in common a pressure device enabling to set both its optimum position with respect to the feed roller 12 and the pressure force value. In another not illustrated example of embodiment, the holding member 13 may be coupled with an adjusting and pressure device that can contain well-known pneumatic or hydraulic cylinders and elements.

In a still another not illustrated example of embodiment, the holding member 13 can be made as an elastic element coupled with at least two adjustment and pressure devices.

Both the distance between the inlet edge 131 of the holding member 13 and the circumference of the feed roller 12 and the minimum distance between the outlet edge 132 of the holding member 13 and the articulated surface of the feed roller 12 are adjustable. Adjustable is also the position of the holding member 13 with respect to the circumference of the feed roller 12 around this circumference of the feed roller 12, as illustrated in Fig. 1 by the direction O, co-determining the position of the feed belt 11 with respect to the rotation axis of the feed roller 12. Consequently, the position of the holding member 13 with respect to the circumference of the feed roller 12 and its distance from the articulated surface of this feed roller 12 depends on the thickness, type, and on the square weight, of the material, as well as on the required staple length of the fibres to be produced.

In a not shown example of embodiment, the holding member 13 comprises a plurality of segments adapted to swing in a common frame, each segment being coupled with its own adjusting screw and with its own spring for adjusting both its

optimum position with respect to the articulated surface of the feed roller 12 and its optimum pressure force. In another not shown example of embodiment, each segment of the holding member 13 is coupled with an independent well-known pneumatic cylinder and with an independent adjustment device for adjusting the thrust value and the optimum position of each segment of the holding member 13 with respect to the articulated surface of the feed roller 12. In still another not shown example of embodiment, each segment of the holding member 13 can be coupled with quite a general adjustment and pressure device which can be linked to a central control so as to permit to use the computer technology for controlling the process of adjustment and regulation of the position and value of thrust of each segment of the holding member 13 in the direction of the articulated surface of the feed roller 12.

The contact line of the outlet edge 132 of the holding member 13 and of the feed roller 12 is called the contact pressure line.

In the direction of the fibre material feed is situated behind the feed device 1 a first opening and cleaning section 2 comprising an opener roller 21 rotatably mounted in the frame of the device and whose axis of rotation is parallel to the axis of rotation of the feed roller 12. The surface of the opener roller 21 is fitted with projections such as saw-shaped teeth or needles. In the particular example of embodiment, the functional surface of the opener roller 21 is fitted with a well-known saw-shaped cover.

In the frame X, under the lower section of the circumference of the opener roller 21, there are in a well-known manner situated cleaning means 22 and 23 made in the example of embodiment shown in Fig. 2 as well-known bouncing knives freely adhering to the articulated surface of the opener roller 21 and connected to a well-known device for the removal of impurities separated from the fibres during the opening and cleaning process. In another, not represented example of embodiment, the cleaning means 22 and 23 are made as well-known combing bars or as other cleaning means.

In the upper half of the opener roller 21 adheres to its articulated surface an upper cleaning means 24, also connected to the well-known device for the removal of impurities, and used for cleaning said surface of the opener roller 21 from impurities clinging to it.

Situated behind the first opening and cleaning section in the direction of the material feed are seated a second and third and, as the case may be, a fourth and fifth opening and cleaning section 2, with both the circumferential velocity of the opener rollers 21 and the density of projections on their articulated surfaces increasing in the direction of the material feed. The total number of such opening and cleaning sections 2 depends on the type of the fibre material to be processed and on the required final purity of each component at the outlet of the device.

In the example of embodiment shown in Fig. 2, three opening and cleaning sections 2 are situated behind the feed device.

In the direction of the material feed, the last opening and cleaning section 2 is followed by an outlet device 3 comprising a collecting roller 31 rotatably mounted in the frame X and whose axis of rotation is parallel to the axis of rotation of the feed roller 12. The outlet device 3 also comprises an outlet belt 32 for the removal of impurities separated from the fibres in the process of the fibre opening and cleaning followed by an outlet mouth 33 for the outlet of opened and cleaned fibres. The outlet belt 32 may pass through the whole device from the opener roller 21 of the first opening and cleaning section 2. To improve the feed of opened and cleaned fibres into the outlet mouth 33, air is additionally sucked into the area behind the collecting roller 31.

The fibre material such as flax and cotton waste, waste of carpets and textile fabrics, other natural and synthetic fibre materials, tyres with non-metallic cord, etc., is laid into the device manually or mechanically, not necessarily in a single layer but so oriented as to facilitate the introduction of the fibre material into the contact pressure line by means of the friction existing between said fibre material and the articulated surface of the feed roller 12 and of the holding member 13.

The fibre material is deposited on the feed belt 11 leading it' to the detector 1A of metallic particles and other hard material and to the feed roller 12 by which it is gripped and led into the continuously narrowing channel between the feed roller 12 and the holding member 13. The position of the contact pressure line with respect to the opener roller 21, the "dimension" of the channel narrowing down between the feed roller 12 and the holding member 13, and the value of the pressure force of each segment of the holding member 13 in the direction of the articulated surface of the feed

roller 12 will be pre-set by a related adjusting and pressure device depending on the thickness and type of the fibre material to be processed. The fibre material is led into the contact pressure line in which it is held by the pressure force exerted by the segments of the holding member 13 on the surface of the feed roller 12. The tilting mounting of each segment of the holding member 13 prevents the function of the device from failing when a variably thick layer such as mutually superposed bits of fibre material gets into the contact pressure line. In such a case the respective segment of the holding member 13 tilts more than the other segments of the holding member 13 which continue to exert constantly high pressure force on the thinner layer of the fibre material. After the thicker layer of the fibre material has been opened, each of the more tilted segments of the holding member automatically reassumes its original position.

The fibres are drawn out of the contact pressure line by getting caught on the projections of the articulated surface of the opener roller 21 and are fed by the opener roller 21 on these projections along the cleaning means 22 and 23 where impurities are separated from them whereupon said fibres are handed over for further opening and cleaning to the following opener roller 21 of the following opening and cleaning section 2. The whole process of the fibre passage from the opener roller 21 of one opening and cleaning section to the opening roller 21 of the next opening and cleaning section with the following movement of the fibres in process of opening along the cleaning means 22 and 23 is repeated according to the number of opening and cleaning sections 2 included in the device.

Since both the total number of projections on the articulated surface of the opener roller 21 and its circumferential velocity are superior to those of the preceding opener roller 21, no opening and cleaning section is in danger of getting clogged.

A part of impurities and fibre remainders remains clinging to the articulated surfaces of the opener rollers 21 even after the fibres have been handed over from the articulated surface of one opener roller 21 to the articulated surface of the next opener roller 21. These impurities are removed by the upper cleaning means 24 situated behind the area where the fibres are doffed from the articulated surface of the opener roller 21 in question, i.e., on the section of the circumference of the opener rollers 21 opposite to that of the well-known cleaning means 22 and 23.

The opened and cleaned fibres are doffed by the collecting roller 31 from the articulated surface of the last opening roller 21 and are in a well-known manner handed over for further processing into the area of the outlet mouth 33 to be fed for further processing. The outlet mouth may be oriented either horizontally or vertically. In the example of embodiment shown in Fig. 4, the outlet mouth 33 is oriented vertically in order to use at least a part of the kinetic energy of the opened and cleaned fibres for facilitating their transport to the area of the outlet mouth 33, supported also by the air suction into the area.

The "impurities" separated from the fibres during the process are put on the outlet belt 32 and in a well-known way removed (fed further on). Their utility value is sometimes superior to that of the fibres proper, for instance in case of bonding agents for sandwich materials or carpets, and they can be utilized accordingly.

CLAIMS

1. A method of fibre production, in particular by recycling otherwise waste fibre materials such as flax and cotton waste, waste of carpets and textile fabrics, other natural and synthetic fibre materials, sandwich fibre containing materials and composite materials with non-metallic fibre reinforcement such as tyres with non-metallic cord, in which the fibre material is pressed in a contact pressure line by a pressure force onto a feed roller fitted with articulated surface, and is taken off the contact pressure line by an opener roller with articulated surface, characterized by that the value of the pressure force varies throughout the length of the contact pressure line depending on the thickness of the fibre material in the contact pressure line thus eliminating the influence of the variations in the thickness of fibre material on the course of its opening process.

2. A method of fibre production as claimed in Claim 1, characterized by adjusting the position of the contact pressure line around the circumference of the feed roller (12) with respect to the opener roller (21) thus permitting to obtain the required staple length of the fibres in process of production.

3. A device for carrying out the method of production according to Claim 1, comprising a rotatably mounted feed roller with articulated surface to whose circumference is related a pressure element behind which in the direction of the feed of the fibre material is rotatably mounted at least one opener roller fitted with articulated surface and having related to the lower part of its circumference at least one cleaning means, in particular a bouncing knife, characterized by that the pressure element is made as a holding member (13) embracing the articulated surface of the feed roller (12) on a part of its circumference and adapted to swing and to be radially adjustable with respect to the articulated surface of the feed roller (12) while being at the same time coupled with an adjusting and pressure device.

4. A device as claimed in Claim 3, characterized by that the holding member (13) is made as an elastic element coupled with at least two independent adjusting and pressure devices.

5. A device for carrying out the method according to Claim 1 comprising a rotatably mounted feed roller with articulated surface to whose circumference is related a pressure element behind which in the direction of the feed of the fibre material is rotatably mounted at least one opener roller fitted with articulated surface and having related to the lower part of its circumference at least one cleaning means, in particular a bouncing knife, characterized by that the pressure element is made as a holding member (13) comprising at least two segments embracing the articulated surface of the feed roller (12) on a part of its circumference, each segment of the holding member being adapted to swing and to be radially adjustable with respect to the articulated surface of the feed roller (12) while being at the same time coupled with an independent adjusting and pressure device.

6. A device as claimed in Claims 3 to 5, characterized by that the pressure element is seated adjustably around the circumference of the feed roller (12).

7. A device for carrying out the method according to Claim 2, comprising a rotatably mounted feed roller with articulated surface to whose circumference is related a pressure element behind which in the direction of the feed of the fibre material is rotatably mounted at least one opener roller fitted with articulated surface and having related to the lower part of its circumference at least one cleaning means, in particular a bouncing knife, characterized by that the pressure element is seated adjustably around the circumference of the feed roller (12).

8. A device as claimed in Claims 3 to 7, characterized by that the feed roller (12) is preceded by a feed belt (11) vertically adjustable with respect to the rotation axis of the feed roller (12).

9. A device as claimed in Claims 3 to 8, characterized by that at least one upper cleaning means (24) is related to the upper part of at least one opener roller (21).

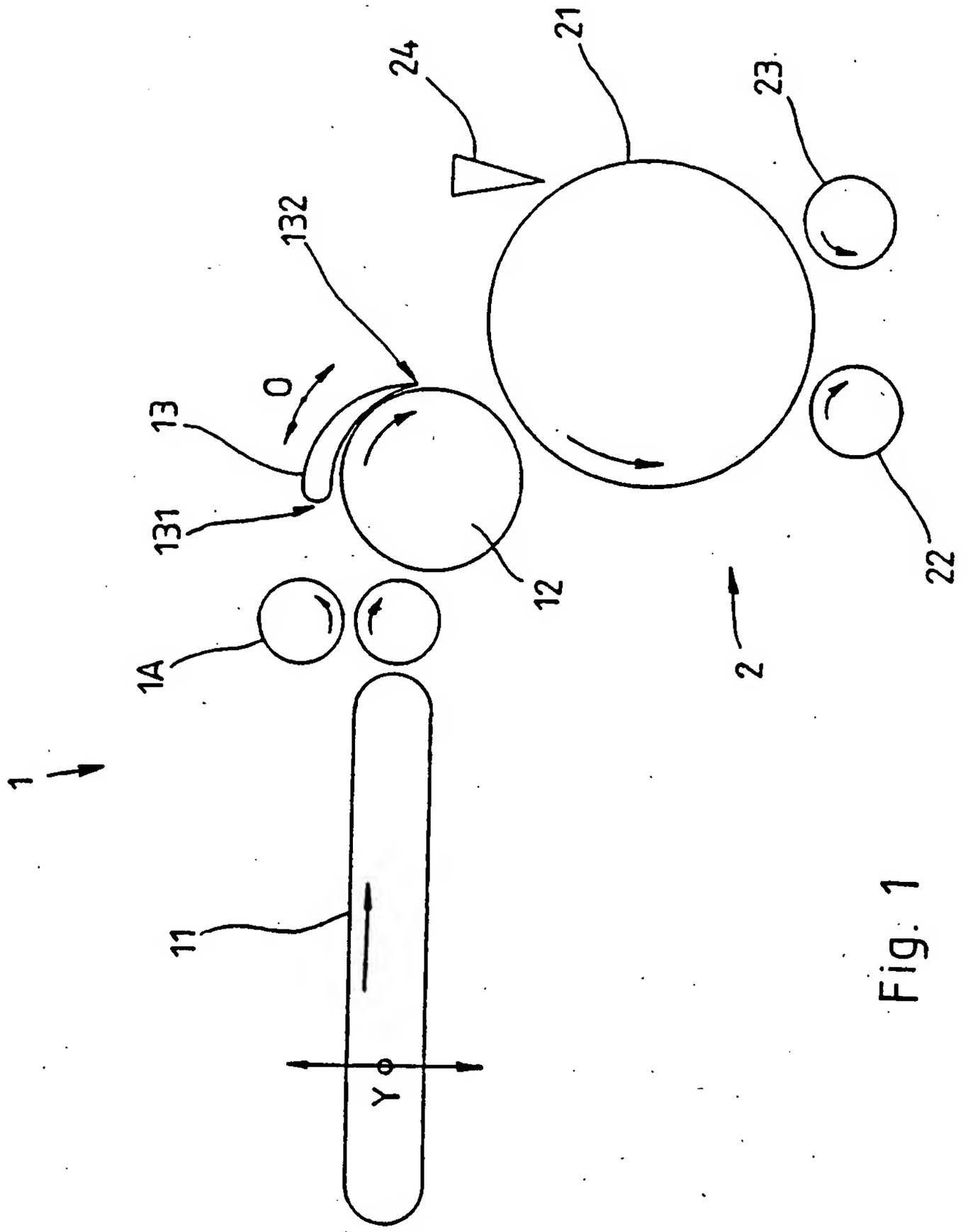

Fig. 1

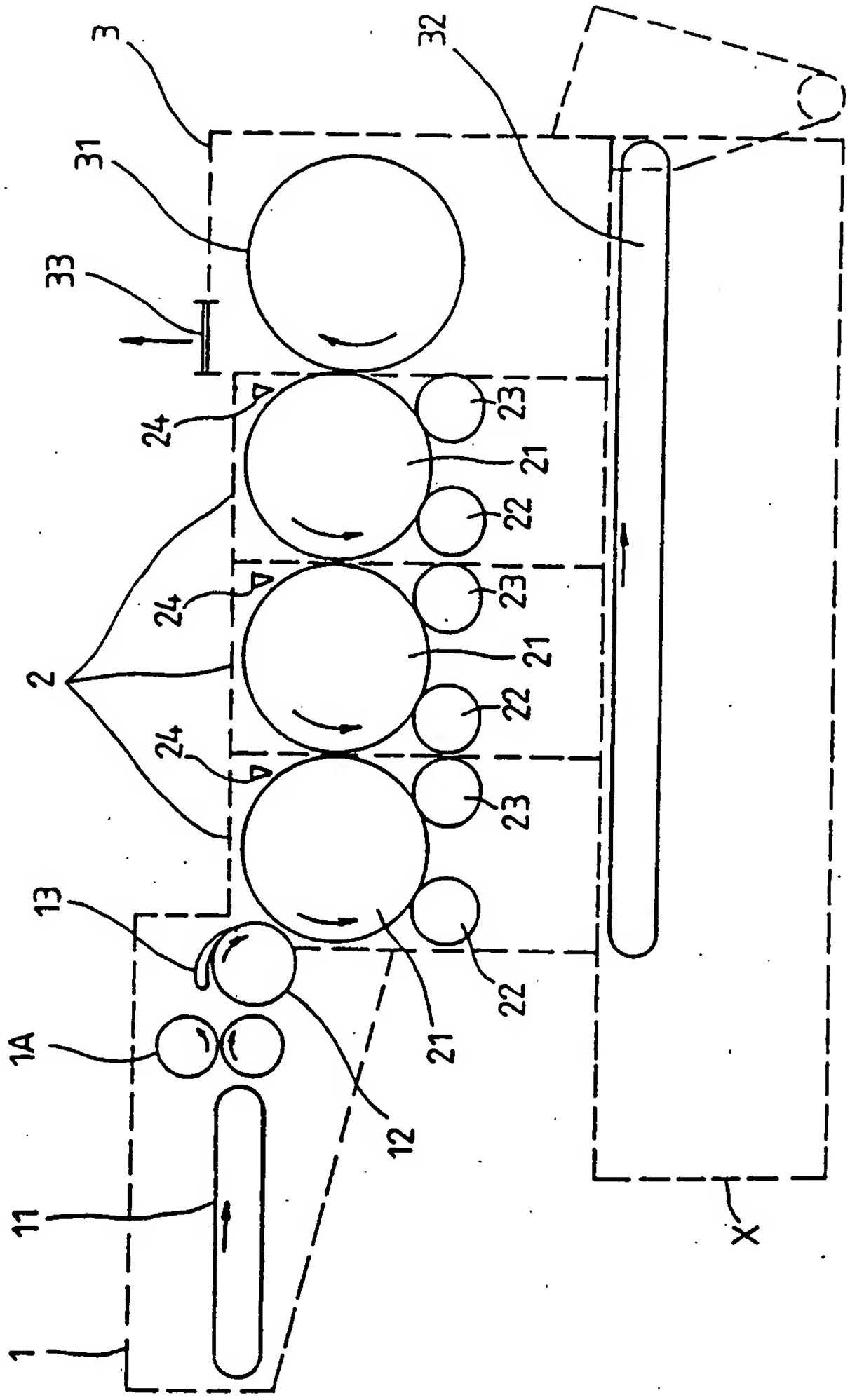

Fig. 2